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NEBC MEETING NEWS

February 2000. Michele Dionne, an aquatic ecologist and Research Director at the Wells National Estuarine Research Reserve in Wells, Maine, spoke on the topic: "Is the tide turning for salt-marsh ecology and restoration in the Gulf of Maine?" The presentation centered on ecological research and habitat restoration efforts at the Wells Reserve, one of 25 federally designated coastal research reserves, and a few other salt-marsh locations in the Gulf of Maine. Describing salt-marshes as "New England's native grasslands," Dr. Dionne highlighted some of their functions and values. Ecologically, they contribute to shoreline anchoring, storm surge buffering, water quality, and habitat for wildlife, fish, and shellfish. For our human society, she noted that there are recreational, commercial, aesthetic, educational, and historical values. In the Gulf of Maine salt-marshes, where mean tide ranges are typically 8–10 ft., there is a close relationship between elevation and vegetational zones, as one might expect. Here one finds *Spartina patens,* salt-marsh hay, dominating high marshes and the taller *S. alterniflora,* which has the capability of exuding salt from specialized cells on its leaf blades, in the low marshes. She described the niches of some of the other plants of the salt-marshes as well, including *Phragmites australis* and *Typha angustifolia,* which occupy the high edges of the salt-marshes and often take over when the hydrologic regime is altered. Dionne described several types of salt-marshes in Maine: (1) back barrier marshes, the typical coastal marsh; (2) fringing marsh, the narrow bands of salt-marsh lining miles of major rivers like the Kennebec and Penobscot, and (3) finger marshes, those found in "drowned valleys" associated with coves and bays.

The oldest salt-marshes in New England are reported to be about 5000 years old. Despite changing sea-levels during this time, they have persisted through accretion of new peat that builds up in response to new sediments brought in by the tides. Dionne emphasized that, conversely, natural events or human activities, such as the construction of roads, beach barriers, jetties, or stream control gates, can interfere with this accretion, causing rapid erosion of salt-marsh habitat. Tidal restriction can lead to such events as subsidence from oxidation of peat, restricted fish passage, less exchange of nutrients and organic matter, water freshening, encroachment by invasive species, and incremental development. The Little River at the Wells Reserve is one of the few rivers and salt-marsh systems that is minimally impacted in the above ways. The Drakes Island marsh system on the southern edge of the Wells Reserve, on the other hand, has been impacted by a number of things including a road built on a berm across the marsh's north end. A water control gate was installed where the Webhannet River went under the road, thus preventing spring tides from entering the marsh from the estuarine lagoon to the east. The gate fell off this structure in 1988, partially restoring the tidal influence. In 1991, scientists began monitoring the changes to the upper marsh (above the gate) where three feet of elevation had been lost from years of abuse. Salt-tolerant plants and marine fish quickly returned to the area, and by 1998, soils were stabilized and a low marsh vegetation dominated by *Spartina alterniflora* was well established in the area. In 1999, *S. patens* was observed colonizing upper edges despite the marsh still being lower than normal. A return to a high marsh is presumed to be many years away yet. In contrast, researchers found a much more rapid restoration of Mill Brook Marsh, located near the mouth of the Squamscott River which flows into Great Bay in Stratham, New Hampshire. It had a somewhat similar history of road impact and gating in 1970 followed by flow restoration in fall 1993. Before restoration, purple loosestrife had become a dominant species in the upstream marsh. Five years after removal of the tide gate and installation of a large culvert, the purple loosestrife was gone and a salt-marsh with three taxa of *Spartina* had been restored.

"Have we stemmed the tide?" Dionne asked rhetorically at the end. Her answer is that we are returning the tide to historical salt-marsh communities in many cases but that many obstacles still exist to maintaining their normal function. There is much concern about development along beaches and upland edges, for instance. Also, there are concerns about predation by the introduced green crab on soft shell clams, an important indigenous species in the marsh ecosystem. It appears that the Wells Reserve is key to research and education on these issues for Gulf of Maine towns where salt-marsh restoration is needed and maintenance is forever.

—PAUL SOMERS, Recording Secretary.

March 2000. The evening's speaker was outgoing President David Conant, whose talk was entitled "The Biology of Tree Ferns." David traced his love of the ferns and field biology to an afternoon foray to New Hampshire's Bear Mountain with mentor Albion Hodgdon. Assaulted by yellow jackets, Hodgdon tumbled one hundred feet, head over heels, down a rocky slope and into the crook of a tree. Fearing the worst, David hurried to Albion's side. Notwithstanding the bites of dozens of yellow jackets, Albion rose to his feet to continue the plant hunt down the mountain. During refreshments at the bottom, David thought, "This is all right!" He happily cast his lot with Albion Hodgdon. A couple of false starts with the ferns of New Hampshire and flora of Sullivan County preceded David's introduction to the tree ferns, and he has been a student of the group since the mid-1970s.

David traced, through the 1980s, the emergence of the use of tools like electrophoresis and analysis of chloroplast DNAs in analyzing relationships among the ferns. Notably, the work of Japanese botanist Haseke has confirmed many of the assumptions of our narrative phylogenies for the ferns with his analysis of the gene for the enzyme (rbcL) that plucks CO_2 from the air to build glucose in the dark reactions of photosynthesis. He confirmed the ancient lineage of primitive ferns like the Osmundaceae, and sorted out the higher leptosporangiate ferns, just as do the narrative phylogenies. As an aside, David said, if we are to recognize many orders of the "younger" flowering plants, this modern work with the ferns underscores abandonment of a single order, Filicales, for all the ferns. For his part, David took his work with the tree fern genus *Alsophila,* begun with Rolla Tryon in 1976, into the modern laboratory. The days of plant collecting with the aid of a converted mail van were followed by collaborations in biochemistry with Gillian Cooper-Driver of Boston University and Gus Dimaggio of Dartmouth College. Analyses of flavonoid pigments and storage proteins were helpful, but not absolutely conclusive in sorting out the tree ferns. Together with Diana Stein of Mount Holyoke College, David moved next to analysis of chloroplast DNAs. David jetted all over the New and Old World tropics to collect the ferns, shipping them back to Diana within two days for grinding. Countless southern blots later, David recounted the horrible experience of trying to make sense of it all, "like trying to put Humpty Dumpty back together again." The two scientists struggled with a number of molecular probes of the collected chloroplast DNAs, settling on ones derived from Christmas ferns to retrieve the clearest set of data.

After years of work, David and Diana produced a fresh picture of the tree ferns as three major groups centered on *Alsophila, Cyathea,* and *Sphaeropteris*. The *Cyathea* clade is not restricted to the New World tropics as previously believed, but linked through geological time to ferns found in Western Queensland and the Pacific. It appears that the Greater Antilles group of *Alsophila* is the most derived of the tree ferns.

David ended his presentation with striking images of hand-prepared sections of fern stems, produced with the help of his students at Lyndon State College. David declared that there is "a lot to learn beyond who they (*sic* the ferns) are!"—a refreshing perspective on teaching and learning, indeed.

April 2000. Dr. Paul Godfrey of the University of Massachusetts at Amherst spoke on "Biodiversity of Medicinal Plants in Northwestern Thailand." Dr. Godfrey has spent the large part of his career investigating aspects of coastal ecology along the Atlantic seaboard. Richard Evans Shultes, who once surprised an NEBC audience by firing a blowgun dart across a crowded hall, inspired Paul's interest in ethnobotany. At this juncture of his introduction, Paul reached for a small bamboo bow and fired its bamboo arrow across the crowded hall. He had our attention.

Paul was asked some years ago by Linda A. Swift of Hartwick College to lend his ecological expertise to an ethnobotanical investigation of plant utilization by an Akha hill tribe village of northwestern Thailand. Thai hill tribes have long used small-scale swidden and crop rotation for maize and rice production. Such swidden-based tropical agriculture is often linked with the loss of biodiversity, though it is critical to the survival of the hill tribes. The long-term studies of forest utilization and plant use around Pakhasukjai Village were designed to measure the impacts of wood gathering, agriculture, medicinal, and spiritual activities on diversity. Drs. Godfrey and Swift expected to find the lowest diversity in disturbed forests close to the village and the highest in undisturbed forests further away. They selected a group of native gingers (Zingiberaceae) to investigate, gathering data on the abundance and distribution of species within three discreet study areas near Pakhasukjai Village in order to evaluate modified importance values and biodiversity indices.

Paul was pleased to find J. F. Maxwell at Chaing Mai University during his first season in northern Thailand. As it turns out, Dr. Maxwell has contributed the largest part of northwest Thai plant specimens to the Harvard University Herbaria during the past several decades. Dr. Maxwell offered his considerable expertise by acquainting Paul and his colleagues with the fine points of collection and identification of the gingers *in situ*. The ethnobotanical team was supported at Pakhasukjai Village by the Hill Area Development Foundation, which provided space and facilities in its rustic center.

The Akha of Pakhasukjai Village are forest dwellers who are spiritually bound to their surroundings. They find both good and bad spirits in the forest. The forests provide both wood and medicines. Paul and his colleagues had great difficulty in learning the uses of medicinal plants, in particular. Two layers of interpretation are needed to get from the native language to Thai, then to English-mediated interviews. Add to the linguistic hurdles the certain possibility of deliberate deception on the part of the shaman, and the team had its work cut out. Ten species of ginger in 7 genera were of particular interest. The list included *Alpinia galanga* (for stomach ache and diarrhea); *Amomum repoense* (for multiple medicinal uses from appetite stimulant to pain reliever); *Boesenbergia rotunda* (similar medicinal uses as *Amomum*); *Costus speciosus* (stimulant, aphrodisiac, or for relief of back pain); *Curcuma longa* (leaf poultice for cuts and bites); *Kaempferia parviflora* (poultice to stop bleeding cuts); and three species of *Zingiber* (for headache, stomach ache, diarrhea, or a stimulant for breast milk production).

Paul devised an ecological sampling plan for three forest sites, each of which had been substantially cleared nearly 50 years earlier. On the first day out, the shaman lead the team by a tortuous and turning path to a very sacred site, the Cemetery Forest. It turned out to be the closest to the village. Diversity of gingers was relatively low here, and greatest within a more heavily exploited site dubbed the Shrine Forest. Several of the gingers appear to respond to changes on the landscape as early successional types. The light and regular disturbance by the Akha may contribute to this increase in overall diversity.

Paul ended his presentation with a personal testimonial. He had learned that a local *Eupatorium* was effective for stanching blood flow. One errant blow of the machete and Paul was able to put the plant to the test. The wound healed nearly overnight.

—DON HUDSON, Recording Secretary.

May 2000. Vice President Paul Somers introduced the evening's speaker, Dr. Avril de la Cretaz, of the Department of Natural Resources Conservation at UMass Amherst. She spoke on her doctoral thesis research topic, "Understory Restoration in a Watershed Degraded by Deer Browsing and Fern Invasion," and won the Club's award for "best performance under adverse circumstances" by giving an outstanding summary of her research despite a balky slide projector.

The Quabbin Reservoir is a 120,000-acre tract of land and water of which 64% is administered by the Metropolitan District Commission (MDC) to protect the Metropolitan Boston water supply. Many of the upland areas of the Quabbin, farmland before being incorporated in the watershed protection area, were planted in white or red pine plantations to protect water quality. Deer hunting was banned in the Quabbin from 1940 to 1991 (originally because of fear of sabotage during WWII), resulting in a deer population of 40–60 deer per square mile. This resulted in intensive browsing on understory vegetation, essentially eliminating tree seedling regeneration from large areas of the Quabbin watershed. The MDC is now interested in restoring a natural forested community to the Quabbin. However, large areas of the watershed, including many of the pine plantations, have a dense monoculture of hay-scented fern (*Dennstaedtia punctilobula*) with essentially no tree regeneration, even after the deer population has been substantially reduced. Dr. de la Cretaz investigated the mechanism by which hay-scented fern influences tree regeneration and mechanical means of control that may allow forest managers to restore the forest. Hay-scented fern, although a native, behaves like many exotic invasives in the landscape by creating mono-dominant stands and altering the natural community diversity and dynamics. Although some studies alleged that hay-scented fern dominance was because of allelopathy, more recent work has shown that these ferns are not necessarily allelopathic. The fern's effect on other species seems to be because of competition for resources, particularly space in the thick root mat and light that is blocked by the fern fronds.

Avril also compared the ability of different tree species to become established in hay-scented fern communities. She found that only white pine and black birch were capable of developing into saplings in a dense fern stand, because the leaves of these species develop and expand before the fern fronds expand in the spring and are therefore able to compete for light. White ash and oak seedling leaves expand after the fern and thus are not as competitive.

In the final stage of her research, Dr. de la Cretaz compared three mechanical treatments to control fern growth and promote tree regeneration: root mat removal (''scalping''), mixing root mat and mineral soil (''scarification''), and clipping (mowing). Herbicide treatments are not allowed in the watershed forest. She found that scarification actually increased the growth and dominance of hay-scented fern. Root mat removal resulted in the greatest germination response of tree seedlings, but also graminoid dominance (sedges, especially *Carex debilis,* established in high densities from the soil seed bank in the first two treatments). Clipping, particularly if done repeatedly during the growing season, resulted in the highest tree seed germination and seedling growth and the lowest fern and graminoid dominance. She hypothesized that clipping is the most effective treatment for tree seedlings because there are fewer graminoid competitors and a higher nutrient availability. The root mat of the ferns may interfere with seed germination, but this effect is outweighed by the increased light available without the dense fern frond canopy.

In summary, Avril's studies showed that the lack of tree regeneration is a result of deer browsing following overstory thinning. Browsing eliminates tree seedlings and depletes the seedbank, while increased understory light accelerates the growth rates of existing fern colonies and increases spore production. This results in the dominance of hay-scented fern: the fern's root mat inhibits germination of any remaining seeds, and the fronds block the light and inhibit growth of any seeds that do germinate. In dense fern stands, trees will not regenerate without intervention, and mowing is a promising mechanical treatment that may be effective for understory restoration.

—LISA STANDLEY, Recording Secretary *pro tempore.*